APPENDIX B

CONSTRUCTION REQUIREMENTS

1.0 GENERAL

1.1 *Revisions to Approved Plans*

All road and drainage construction shall be performed in accordance with the plans and profiles and typical details approved by the Planning Board. Changes or revisions to the approved plans and profiles or subdivision plans caused by unanticipated conditions encountered during construction shall be designed by the developer's engineer and shall be subject to the approval of the Planning Board and the Consulting Engineer.

1.2 *Standard Specifications*

Any item of work for which there are no specifications contained herein, shall conform to the current "Standard Specifications for Road and Bridge Construction," State of New Hampshire Department of Transportation, hereinafter referred to as the "Standard Specifications".

1.3 *Modifications to Typical Cross Section*

The Standard Specifications and the Town of Litchfield typical roadway cross-sections and details are for the specified roadway classifications and may be changed in the case of streets for commercial or industrial areas that would require heavy truck traffic.

1.4 *Developer's Responsibility*

The developer, contractor, or subdivider is responsible for all engineering work, and all references to measurement and payment therein are for the convenience of the owners and subdivider in dealing with their own contractors and shall not refer to the Town of Litchfield.

1.5 *Staging Areas*

Staging areas, construction materials, debris and above ground fuel storage tanks shall not be located within 300 feet of a wetland.

2.0 CLEARING AND GRUBBING

2.1 *Limits*

(*Sept. 2001)* The limits of clearing and grubbing shall be laid out on the ground before any other work commences and shall extend five (5) feet beyond the excavation and embankment slope limits. Trees designated by the Planning Board or its agent will be saved: particular reference is made to fruit, ornamental or shade trees or plants at the edge of the roadside slopes. No chipped trees, branches, building debris or vegetation shall be used as backfill against or near a structure or foundation to minimize potential settling and insect breeding areas.

2.2 ***Clearing***

(*Sept. 2001)* Clearing shall be performed by cutting and disposing of trees, down timber, stubs, brush, bushes and debris. All clearing materials shall be chipped and evenly distributed on the surface or shall be removed from the site. It is required that developers check with the County Forester or Conservation Commission prior to on-site distribution.

2.3 ***Grubbing***

(*Sept. 2001)* The developer shall remove and dispose of all stumps and large roots within the limits of the roadbed. Stumps and large roots shall be chipped and evenly distributed on the surface or shall be removed from the site. It is required that developers check with the County Forester or Conservation Commission prior to on-site distribution. Except in areas to be excavated, excavation caused by grubbing operations shall be filled with suitable material, which shall be compacted to conform to the surrounding ground.

2.4 ***Roadside Cleanup***

(*Sept. 2001)* Roadside cleanup of leaning, dead unsound trees, branches, stubs, refuse, and slash, generally to a limit of approximately 15 feet outside the slope limits, shall be performed and the material shall be disposed of by chipping and evenly distributing on the surface or removal from the site. It is required that developers check with the County Forester or Conservation Commission prior to on-site distribution.

3.0 EXCAVATION AND EMBANKMENT

3.1 ***General***

a. Standard Specifications: All excavating and filling required for construction of improvements shall be as specified herein and in accordance with Section 203 of the "Standard Specifications". The entire area of work shall be brought to the required lines and grades by excavation or filling. Excavation material, if suitable, may be used in making embankments and in filling low areas. All streets shall be graded to approved grade and cross-section. Upon completion of filling and excavating, the subgrade shall be formed to the required grade and contour, and the entire surface again rolled as specified above. High spots shall be removed and low spots filled with an acceptable material and the process of leveling and rolling continued until no further depression results.

b. Side slopes: Side slopes shall be constructed to the line and grade specified on the approved plans and/or cross-sections. Side slopes in embankment and on roadside drainage ditches shall normally descend one (1) foot vertically for at least each four (4) feet horizontally (4 to 1). Surplus material resulting from excavation of the road prism shall be used to flatten slopes of embankment so that they ascend one (1) foot vertically for at least four (4) feet horizontally (4 to 1). Side slopes in rock excavation shall ascend two (2) feet vertically for at least each one (1) foot horizontally (1 on 2). Where rock cuts have a face higher than ten (10) feet vertically, a three (3) foot berm shall be provided at each ten (10) foot level above the grade at the end of the pavement. Refer to the Town Typical Roadway Section(s) for more information on side slope construction.

3.2 ***Excavation***

a. Topsoil: Topsoil and other desirable humus material shall be removed in excavation areas and also in fill areas to such depths as directed by the Road Agent or Consulting Engineer.

b. Unsuitable Subgrade Material: All stumps, soft clay, mulch, loam, peat and all other yielding material or material subject to organic decomposition, shall be removed from the entire area within the slope limits in accordance with the "Standard Specifications". In those locations where the alignment crosses swamp or marshlands, or other similar soil that is incapable of withstanding expected loads, such inadequate soil shall be entirely removed and replaced with adequate material. The materials so removed shall not be placed in embankment, but may be used in flattening embankment slopes or for filling low spots outside the road section. The Planning Board may require the developer to submit evidence of boring and/or other soil investigations to determine the depth, composition and stability of the subgrade within the road section.

c. Rock Excavation: All boulders shall be broken off to a depth of not less than 24 inches below subgrade. Solid rock shall be removed also to a depth of not less than 24 inches below subgrade and as required for ditches in cut sections. The finish side slopes shall be constructed as shown on plan approved by the Planning Board and this shall be in conformance with the roadway ledge excavation detail provided with the roadway typical section.

d. Common Excavation: Common excavation consisting of all excavation not included in the above classifications shall be removed. With the approval of the Road Agent, suitable material may be used in fill areas and unsuitable material may be used to flatten slopes where possible.

3.3 ***Embankment***

a. Materials: Embankments shall be formed of suitable and acceptable excavated material and brought to the required lines and grades. The materials for embankments and subgrades shall be placed in successive compacted horizontal layers not exceeding twelve (12) inches in loose depth, extending across the entire fill area. They shall be spread by a bulldozer or other acceptable methods, and shall be thoroughly compacted. Successive layers shall not be placed until the layer under construction shall have been thoroughly compacted. Where embankments are made of rock, the rock shall be so deposited that all voids are filled with earth and in such a way that the compaction specified above may be secured.

b. Backfill of Holes: Holes resulting from removal of stumps, boulders, and the like, within the zone of anticipated frost action, shall be filled and compacted with material similar to that surrounding the hole.

c. Waste Material: Waste materials from clearing, grubbing, and roadside cleanup and from rock, muck, and common excavation classified by the Road Agent as unsuitable for use in construction of roads, streets, and landscaping shall be disposed of in an approved stump dump, on-site, or chopped.

d. Rock Embankment: Rock embankment shall consist of rock fragments placed in layers not to exceed 4 feet. The rock lifts shall be worked in such a manner as to close the voids with spalls and fines when available, otherwise use earth to make a tight surface prior to placing the next lift.

e. Grading: Embankments shall be graded at all times to insure the run-off of water. Any saturation of nonporous material due to the subdivider's selected method of operation will occasion suspension of additional work by the Road Agent or the Consulting Engineer until the situation has been rectified.

4.0. WINTER CONSTRUCTION METHODS

No embankment shall be constructed on frozen earth materials. Each layer of material placed shall be compacted to the required density before it freezes. All frozen material shall be removed from the top of embankments prior to placing additional material. The frozen lumps of earth removed shall be placed outside of the limits of an assumed 1-1/2 to 1 slope from the break in the shoulder and inside the designed or ordered slope line. If the above-specified conditions cannot be met, earthwork operations shall be suspended.

5.0 DRAINAGE

5.1 *General*

a. Drainage: Stormwater and Erosion Control measures shall comply with Appendix D, (*Stormwater Management and Erosion Control).* Adequate disposal of surface water run-off shall be provided by the subdivider. Ditches and culverts shall be installed as shown on the final plat (plan), profile, typical sections and cross-sections as approved by the Planning Board. If during construction, it develops that additional drainage pipes or structures are needed, the Consulting Engineer shall require, with Planning Board approval, such additional installation(s) before acceptance of the road(s). *(Amended May 2003)*

b. Site Conditions: Minor revisions to the location of the proposed drainage pipes and structures due to varying site conditions may be made in the field providing intent of the drainage design is not compromised.

5.2 *Culverts*

a. Lengths: In addition to the location as shown on the approved plans the length of a culvert structure shall be graphically determined by cross-section scale drawing(s) of the proposed street showing existing ground, side ditches, back slope(s), side slope(s), with headwall(s) if required. Culvert length shall not be compromised and culvert construction shall not result in a roadside safety hazard to motorists or pedestrians. Culverts without headwalls or drop inlets shall extend to the intersection of the street side slope in an earth fill section; or with the backslope in an earth set section governed by the cover over the culvert specified below. Culverts with headwalls may be shorter as governed by the intersection of the street side slope with the back of the headwall 5 inches below the top of the headwall.

b. Materials: Drainpipes shall be Reinforced Concrete Pipes. No substitution of pipe material shall be made without approval of the Road Agent or the Consulting Engineer.

c. Headwalls and End Sections: All culverts shall be constructed with a concrete end section, all pipes 48" diameter and greater shall be constructed with headwalls, headwall or stone slope paving as specified below. End sections shall be constructed on all pipes less than 48" diameter, unless there is an active stream then pipes between 21" and 48" diameter shall be constructed with a headwall. A stone or masonry headwall on the inlet end of a culvert, when required, shall be designed to prevent physical damage to the culvert pipe and have a base, below the pipe, to avoid seepage and erosion

below the culvert. Headwalls on the outlet end of the culvert may be required, but without a deep base.

d. Construction: All pipes shall be laid upon a firm bed, true to line and grade, and backfilled, tamped in layers not exceeding six (6) inches, in a workmanlike manner. Care shall be taken that the backfill material within six (6) inches of the pipe shall be securely attached to the adjoining section by the approved methods for the type of joint being used.

5.3 ***Catchbasins***

a. Materials: Catchbasins and drop inlets shall be pre-cast concrete or concrete block construction as specified in the NHDOT standard construction details. Grates and frames shall be cast iron, NEENAH Foundry Company No. R-3495 or approved equal. All basins and drop inlets shall be constructed with a concrete "collar" (see Exhibit E).

b. Construction: Catchbasins and other drainage structures shall be built to the standards of the New Hampshire Department of Transportation. Attention shall be made to specify, on the construction plans, the proper type of grate for each basin installation.

5.4 **Underdrains**

a. General: Underdrain pipe shall be constructed as shown on the plans and/or at other locations determined in the field during roadway construction. Generally, subsurface drainage systems (underdrain) shall be provided where the seasonal high groundwater table is within five feet of the finished roadway grade. Test pits or borings in roadway cut sections shall be taken, as required or ordered by the Board's Agent, to locate the seasonal high water table (SHWT) and determine the need for underdrain pipe. The minimum size underdrain shall be 6" in diameter.

b. Materials: Underdrain pipe shall be metal or solid wall PVC pipe.

c. Construction: Underdrain pipe shall be constructed in accordance with the NHDOT standard specifications and typical construction detail.

5.5 ***Ditches***

a. General: Drainage ditches shall be constructed at those locations shown on the approved plans and other locations necessitated by field conditions. Ditches shall be used at the top of backslopes only when excessive offsite could damage and/or overtax on-site systems.

b. Erosion: All ditches shall be checked for possible erosion and subsequent siltation of streams. Acceptable methods of treatment include matting for erosion control, stone for erosion control, stone fill and riprap. Generally, all ditches steeper than 5% should be adequately protected against soil erosion. Matting for erosion control or stone linings shall be provided, as determined by an engineering evaluation.

6.0 SUBGRADE

6.1 *Fine Grading*

Upon completion of excavation, placement of embankment and installation and backfilling of drainage structures, the subgrade shall be fine graded to conform to the profile grade for subgrade and cross slope. High slopes shall be honed down and low spots filled with acceptable material. The process of rolling or vibration compacting shall continue until no further depressions result. Shoulders, slopes and ditches shall be shaped to reasonably smooth surfaces in keeping with the character of the adjacent terrain and merge into it without any noticeable break. Culverts and waterways shall be cleared of all obstructions. Rubbish, brush, loose rock, boulders and all other debris from the construction work shall be removed and disposed of. The entire roadway must present a uniformly finished appearance at the completion of fine grading. The Road Agent and the Consulting Engineer shall be notified so that approval of fine grading of the subgrade, shoulders, side slopes and ditches can be made before any further work can progress.

6.2 *Grade Stakes*

It shall be the responsibility of the developer to have grade stakes put in at 50-foot intervals. Each stake shall be driven firmly beyond the toe or top of the slope in a location where it will not be disturbed by construction operations and be clearly marked to give the following information:

* Station
* Offset from centerline
* Cut or fill to finished centerline grade.

The developer shall preserve the grade stakes until the completion of the streets, and, if stakes are removed or destroyed so that the Consulting Engineer cannot readily check the grade at any location, the stakes shall be replaced at the expense of the developer.

7.0 ROADWAY BASE COURSE

7.1 *Gravel Base Course*

The base of the road shall be composed of a minimum twelve (12) inches of bank-run gravel, including material up to six (6) inches diameter. The gravel shall meet the specifications for gravel set forth in Section 304 of the "Standard Specifications". The base shall be laid in separate six (6) inch compacted layers to the required width, centered within the right-of-way.

7.2 *Crushed Gravel Base Course*

On the base shall be laid a minimum of six (6) inches of crushed gravel (12” for arterial roadways), spread to the required width (see approved typical section for the exact crushed gravel thickness). The crushed gravel shall meet the specifications for crushed gravel set forth in Section 304 of the "Standard Specifications".

7.3 ***Sand Course***

In ledge or rock cuts a 24" sand blanket shall be constructed. The sand shall meet the specifications for sand set forth in Section 304 of the "Standard Specifications".

7.4 ***Grading Procedure***

The subgrade shall be to the specified crown and grade and maintained in a smooth condition, free from holes and ruts. If the hauling equipment should cause ruts in the subgrade or previously placed base course, the equipment shall be operated only on the course being placed, behind the spreading equipment.

Care shall be taken to avoid segregation when placing sand, gravel and crushed gravel. When base course material is dumped in piles, it shall be dumped in the course being placed, and spread at once onto the previously placed layer. If spreading equipment is not available, dumping will not be permitted. Any separation, which occurs, shall be remedied or the materials removed and replaced at the subdivider's expense.

Each entire layer of gravel shall be thoroughly scarified for the full depth of the layer to bring all oversized stones to the surface for disposal prior to placing the subsequent course. Such scarifying will not be required when the Contractor's method of operation is such that oversized stones are not delivered to the project.

Previously tested and accepted materials contaminated by earthen, organic, or other foreign matter, or degraded by hauling equipment, to such an extent that the materials cease to meet the requirements, shall be removed and replaced or otherwise made acceptable at the Contractor's expense.

To prevent segregation of crushed gravel during spreading and to assist in obtaining the required density of the mixture, water shall be added to the crushed gravel prior to performing the grading operations. The course shall be maintained in a moist condition until it is covered. Water shall be uniformly applied over the base courses during compaction in the amount necessary for proper consolidation.

The compaction of sand, gravel and crushed gravel shall be done with an approved vibratory roller until 95% of maximum density is achieved.

7.5 ***Fine Grading Procedure***

Prior to the start of fine grading, the contractor shall stakeout the centerline of the road at 50 foot intervals. The stakes shall be flagged in blue showing crushed gravel grade and corresponding slope grade on side slopes. These stakes and grades shall be kept throughout the fine grading operation in order to check alignment and crown in the road and may not be removed until just prior to paving.

The contractor shall have the following equipment on site prior to starting fine grading: Grader with a straight edge, water truck, and an 8-1/2 ton steel drum vibratory roller.

Grades shall be checked and rechecked during final grading in order to get a uniform grade. Grades shall be maintained in front of the water trucks and rollers in order to get grade and essential compaction. This grade shall remain undisturbed until paving.

7.6 ***Winter Construction Methods***

Base course material shall not be placed upon or above frozen material. If the density requirements are not fulfilled for any layer before the material freezes, not further material shall be placed upon that layer.

8.0 ROADWAY PAVEMENT

The pavement shall be a two-course hot bituminous pavement constructed to the widths shown on the approved typical section and will include a one (1) inch wearing surface (after compaction). The average application rate shall be .057 tons per square yard per inch of thickness.

9.0 SIDE SLOPES

A minimum of three (3) inches of topsoil shall be provided to cover over all finished slopes, and it shall be spread uniformly over all finished slopes. Finished slopes shall be loamed, fertilized, limed, seeded and mulched in accordance with Sections 641 through 647 of the "Standard Specifications".

10.0 MISCELLANEOUS ITEMS

10.1 ***Utilities***

Utilities will be placed after the project has been brought to subgrade and rough slope work has been completed. The lines will be inspected by their respective companies. It is recommended that all electric, telephone, cable, and other overhead lines will be placed underground.

10.2 ***Guardrail***

Guardrail will be required where slopes extend more than 10 feet on a 2:1 slope or in other hazardous areas, which are determined by the Road Agent and the Planning Board. The guardrail and associated terminal units shall be constructed at location shown in the roadway typical section.

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